Epicardial Pacing Wires: Removing

What are Epicardial Pacing Wires?

During cardiac surgery, the heart’s normal physiologic pacemaker cells can be temporarily or permanently injured and unable to maintain a normal cardiac rate and/or rhythm. Epicardial pacing wires (also called epicardial pacing leads; Figure 1) are wires with electrodes at the tip that are attached to the surface of the heart (i.e., the epicardium) during surgery; the distal ends of the wires are drawn through small punctures to the external surface of the patient’s chest and secured. The wires can be connected to an artificial pacemaker to regulate the heart rate and/or correct dysrhythmias (for more information, see Nursing Practice & Skill... Epicardial Pacing Wires: Caring for and Using).
What is the Desired Outcome of Removing Epicardial Pacing Wires?
› The desired outcome of removing epicardial pacing wires is for removal to occur with minimal discomfort and the absence of complications

Why is Removal of Epicardial Pacing Wires Important?
› Removing epicardial pacing wires when no longer clinically indicated reduces the risk of infection and microshocks that can occur when the wires are in place
› Correct removal of epicardial pacing wire is necessary to prevent potential complications, including dysrhythmias, bleeding, and (rarely) cardiac tamponade (see Facts and Figures, below)

Facts and Figures
› Temporary epicardial pacing wires have been placed routinely during cardiac surgery in the U.S. since the 1960s (AlWaqfi et al., 2014)
› Investigators who reviewed relevant research to determine whether it is safe to cut epicardial pacing wires flush with the skin rather than remove them found that retained pacing wires were associated with a wide spectrum of complications, usually after a long dormant period, due to migration of the wires to other parts of the heart, lungs, and peritoneal cavity. The authors concluded that epicardial pacing wires should be completely removed when possible due to the risk for severe complications (Shaikhrezai et al., 2012)
• Case studies in the literature regarding complications associated with wire retention include
  – a 45-year-old man who developed a hematoma on the right atrium (RA) around a retained epicardial pacing wire (Sharma et al., 2013)
  – a 60-year-old woman who developed a breast abscess following migration of a retained epicardial pacing wire (Jafferjee et al., 2014)
› Epicardial pacing wire removal is typically performed without complication. Researchers prospectively collected data on epicardial wire placement and removal in a large cardiac surgery unit. They reported that 86.5% of patients received ventricular wires and in 15% of patients weaning from cardiopulmonary bypass (CPB) was facilitated by pacing. Physicians and nurses used an equal amount of tension to remove the wires, and no difference in tension was noted when removing atrial versus ventricular wires. There were no patient factors that correlated with the amount of tension applied to remove the wires, and no major complications due to wire removal were reported (Elmistekawy et al., 2016)
• Cardiac tamponade requiring reoperation for bleeding is a rare complication of epicardial pacing wire removal. Fewer than 1% of patients required reoperation for bleeding following wire removal. Patients experiencing tamponade did not always demonstrate changes in vital signs (e.g., tachycardia, hypotension); common early signs and symptoms were bleeding and dyspnea (Mahon et al., 2012)
› Researchers performed a secondary analysis of two research studies and determined that patients most often report “a ‘mild to moderate pulling’ sensation” during epicardial pacing wire removal (Mullin et al., 2009)

What You Need to Know Before Removing Epicardial Pacing Wires
› Prior to caring for a postoperative patient with epicardial pacing wires, the nurse should have knowledge of the following:
  • Care of the postoperative cardiac surgery patient (for more information, see the appropriate Nursing Practice & Skill papers)
  • Epicardial pacing wire positioning and removal
    – Epicardial pacing wires are placed during cardiac surgery. The proximal end of each wire is loosely, yet securely, attached to the epicardium of the heart; a long thoracic needle at the distal end of the wires is used to bring the wires through the chest wall to the external surface of the patient’s chest. The thoracic needle, which is scored, is then broken off, a knot loosely tied in each wire at the exit site, and the knot sutured to the patient’s skin to prevent wire dislodgement
    - Note: Protocols vary according to facility and surgeon, and not all facilities and surgeons will knot and suture the wires
    – Historically patients received two pairs of unipolar epicardial pacing wires: one pair attached to the epicardium of the RA and a second pair attached to the epicardium of the right ventricle (RV) (Figure 2); one lead in each pair is a negative pacing electrode (anode) that can be attached to an external pacemaker as needed (Figure 3), and the other is a positive or grounding electrode (cathode) that is attached to the chest wall. Bipolar epicardial pacing wires—in which the positive and negative electrodes are contained close to each other in the tip of the same wire—are often now used; one bipolar
pacing wire is placed on each the RA and RV, the wire splits outside the thorax, and both leads can be attached to an artificial pacemaker as needed.

Figure 2: Unipolar epicardial pacing can be placed in pairs on the epicardium of the right atrium and right ventricle during cardiac surgery. Copyright© ZooFari, 2010. Licensed under Creative Commons Attribution-Share Alike 3.0 Unported License.

Figure 3: Examples of temporary and permanent artificial pacemakers. Copyright© 2014, EBSCO Information Services.

- Gloves must be worn when handing the wires and the distal ends of the wires insulated to reduce risk for shock
- Removal of pacing wires is performed at least 24 hours prior to patient discharge from the ICU in order to permit time to monitor the patient for and intervene in the event of an arrhythmia
- Advanced Cardiac Life Support (ACLS) certification
- Cardiac monitoring and rhythm interpretation (for more information, see the related series of Nursing Practice & Skill papers)
- Cardiac monitoring during epicardial pacing wire removal is important because there is a risk that patients can develop arrhythmias during the procedure
- Aseptic technique, which is used when removing epicardial pacing wires to reduce risk for infection (for more information, see Nursing Practice & Skill ... Aseptic Technique and Infection Prevention: Applying Principles at the Bedside)

Preliminary steps that should be performed before removing epicardial pacing wires include the following:
- Review facility/unit specific protocol for removal of epicardial pacing wires, if one is available
- Review the treating clinician’s orders for epicardial pacing wire removal
- Verify completion of facility informed consent documents
  - Typically, the general consent for treatment executed by patients on admission to a healthcare facility includes standard provisions that encompass care of the patient with epicardial pacing wires
- Review the manufacturer’s instructions for all equipment to be used and verify that the equipment is in good working order
- Review the patient’s medical history/medical record for
- type of heart surgery performed
- confirmation that coagulation and electrolyte studies are normal to reduce risk of bleeding and cardiac arrhythmias
  - If the results are abnormal, advise the treating clinician and confirm the order to remove the wires
- any allergies (e.g., to latex, medications, or other substances); use alternative materials, as appropriate

Gather the necessary supplies, which typically include the following:

- Nonsterile gloves and other personal protective equipment (PPE) as necessary
- Equipment to assess vital signs
- Facility-approved pain assessment tool
- Analgesic agent, if ordered
- Suture removal kit (or supplies gathered individually if no kit available)
  - Sharp, pointed scissors
  - Sterile gloves
  - Facility-approved antiseptic wipes (e.g., povidone iodine, 2% chlorhexidine-based solution)
- Gauze dressing and tape, if not included in suture removal kit
- Additional gauze pads to insulate the distal ends of the epicardial pacing wires, if needed
- Cardiac monitoring equipment, if not already in use
- **Crash cart** in close proximity of the patient
- Written materials to reinforce patient education, if available

**How to Remove Epicardial Pacing Wires**

- Perform hand hygiene and don PPE if exposure to body fluids is anticipated
- Identify the patient using two unique identifiers or according to facility protocol
- Establish privacy by closing the door to the patient’s room and/or drawing the curtain surrounding the patient’s bed
- Introduce yourself to the patient and family member(s), if present; explain your clinical role; assess the coping ability of the patient/family and for knowledge deficits and anxiety regarding epicardial pacing wire removal
  - Determine if the patient/family requires special considerations regarding communication (e.g., due to illiteracy, language barriers, or deafness); make arrangements to meet these needs if they are present
    - Use professional certified medical interpreters, either in person or via phone, when language barriers exist
  - Answer any questions and assure the patient that removal of wires is usually associated with a slight tugging sensation and mild, fleeting pain
- Request that family members and other visitors exit the room as necessary to maintain asepsis
- Assess the patient’s general health status, including vital signs and level of pain using a facility-approved pain assessment tool
  - Administer an analgesic agent, if indicated and/or ordered, prior to wire removal and allow time for therapeutic effect
- Verify that the patient is attached to a cardiac monitor, has a stable cardiac rhythm, and is not pacemaker dependent (i.e., the patient is not dependent on the pacemaker to maintain a stable rhythm)
  - Run a cardiac monitor strip to document the patient’s heart rate and rhythm prior to wire removal
  - **Do not remove the epicardial pacing wires if the patient is pacemaker dependent**
- Confirm the patient has I.V. access for emergency fluids or medications, if needed
- Position the patient in bed for easy access to the wires. Help arrange the patient gown or provide draping for comfort and privacy
- Prepare to remove the pacing wires
  - Don nonsterile gloves prior to handling wires
  - If the wires are attached to an external artificial pacemaker,
    - verify that the pacemaker is turned off
    - remove the distal ends of the epicardial wires from the connecting cable
    - wrap the end of each wire in cotton gauze, or other material such as the tips of a sterile glove or a sterile syringe cap secured with tape, to insulate
  - Remove the dressing covering the wires and exit sites, taking care not to tug on, dislodge, or damage the wires
  - Evaluate the integrity of the wires, sutures, and the exit sites. Examine for signs of infection such as redness, swelling, tenderness, pain, or exudate
    - Notify the treating clinician if there are any signs and symptoms of infection
    - Separate the wires from each other while keeping the tip of each wire protected by the insulating material
- Remove gloves and perform hand hygiene
- Remove the pacing wires
  - Using aseptic technique, open the suture removal kit and a packet of 4 x 4 gauze
  - Don nonsterile gloves
  - Using aseptic technique, gently clean the exit sites using the antiseptic swabs and allow to dry (approximately 30 seconds)
  - Cut and remove the sutures anchoring each wire to the patient’s skin using scissors or scalpel
  - Remove each epicardial wire individually by pulling on it firmly but gently until it is removed completely, observing for cardiac arrhythmias while pulling each wire. Note: Cardiac arrhythmias are common during epicardial wire removal
    - Anchor the skin near the exit site with the free hand while withdrawing the wire, which may prevent unnecessary pain to the patient
    - The wires should be easily removed, although there may be some resistance if the wires have been in place for a long time. If there is undue resistance, stop attempts to withdraw the wire and contact the treating clinician
  - Repeat with additional wires
- Examine each wire to confirm that it is intact and there is no tissue adhering to the tip
  - If bleeding is noted, apply pressure until hemostasis is achieved
  - Inform the treating clinician if there is any tissue adhering to the tips of the wires, if the wires do not appear to be intact, or bleeding does not stop
- Apply an occlusive dressing to the exit sites
- Assess vital signs and for cardiac tamponade (see Other Tests, Treatments, or Procedures that may be Ordered Before or After Epicardial Pacing Wire Removal and Red Flags, below); notify the treating clinician of any significant changes from baseline
- Dispose of used procedure materials and PPE according to facility protocol
- Remove gloves and perform hand hygiene
- Update the patient’s plan of care, if appropriate, and document removal of epicardial pacing wires in the patient’s medical record, including the following information:
  - Date and time epicardial pacing wires were removed
  - Description of the procedure (e.g., ease with which wires were removed)
  - Patient assessment information, including
    - the condition of the wire exit sites
    - patient’s level of pain, before and after analgesic agent administration, as appropriate
    - vital signs and heart rhythm interpretation
      - Include a cardiac monitor strip
    - patient’s tolerance of wire removal
  - Any unexpected patient events or outcomes, interventions performed, and whether or not the treating clinician was notified
  - Patient/family education, including topics presented, response to education provided/discussed, plan for follow-up education, and details regarding any barriers to communication and/or techniques that promoted successful communication

Other Tests, Treatments, or Procedures That May be Necessary Before or After Removing Epicardial Pacing Wires
- Coagulation and electrolyte studies are necessary prior to wire removal to assess risk of bleeding and cardiac arrhythmias with wire removal
- Monitor vital signs and cardiac rhythm every 15 minutes for the first hour, every 30 minutes for the next 2 hours, and hourly for 2 more hours
  - Notify the treating clinician immediately if there are any significant changes in the patient’s condition, especially changes in heart rate and rhythm and/or blood pressure
- Maintain the patient on bedrest for one hour after the wire removal, per clinician orders and/or facility protocol, and ensure that the patient does not receive any treatments (e.g., chest percussion) that create pressure changes within the chest for at least 4 hours after the procedure in order to minimize the **risk for bleeding and other potential complications**
- A chest X-ray might be ordered following to ensure that no portion of the wires was retained
- Bacterial culture and antibiotic sensitivity testing followed by appropriate antimicrobial therapy can be necessary if infection or sepsis is suspected
What to Expect After Removing Epicardial Pacing Wires

- The patient should experience minimal pain or discomfort during the care or removal of the epicardial pacing wires.
- After assessment or dressing change, the wires and the surrounding insulating material will remain intact and the wires sutured securely to the patient’s skin.
- No infection will develop at the exit site.
- Abnormalities in the patient’s heart rate and/or rhythm will be treated promptly and effectively.

Red Flags

- Epicardial pacing wires can cause microshocks, which can result in an arrhythmia, particularly ventricular fibrillation.
  Precautions that are necessary to reduce the risk for microshocks include:
  - the clinician always wearing gloves when handling the wires
  - verifying that all electrical equipment is grounded
  - strategies to prevent static electricity (e.g., avoiding carpet)
- Complications related to epicardial pacing wires are rare but can be serious; complications are more common in patients with a history of heart failure, repeat heart surgery, or anticoagulant therapy. If any of the following occur, the treating clinician should be notified immediately, the patient should be monitored closely and, if needed, appropriate life support measures undertaken. Potential complications include:
  - arrhythmias or cardiac tamponade (evidenced by anxiety, muffled heart tones, hypotension, tachycardia, jugular venous distention [JVD], decreased peripheral pulses, dyspnea) can be caused by lacerations to the atria and/or ventricle due to dislodged epicardial wires or wire removal
  - Cardiac tamponade can also be caused by disruption of cardiac anastomoses during wire removal
  - bleeding at the exit site
  - infection as noted by fever, redness, swelling, pain, tenderness, or exudate at the exit site. Localized infection may, if not managed aggressively, lead to infection of the heart muscle or potentially life-threatening sepsis
  - dysrhythmias or cardiac arrest may occur if the cardiac pacing wires inadvertently deliver an electrical shock to the patient’s heart

What Do I Need to Tell the Patient/Patient’s Family?

- Reassure the patient/family that epicardial pacing wire removal is typically associated with a tugging sensation and mild, fleeting pain, and that the procedure is typically accomplished without complications.
- Reinforce any activity restrictions ordered.

References